WE CLAIM:

1. A pharmaceutical composition comprising:

(i) an active ingredient;

(ii) an amino acid polymer; and

(iii) a pharmaceutically acceptable excipient.

2. The pharmaceutical composition of claim 1, wherein said amino acid polymer is a glutamic acid polymer.

3. The pharmaceutical composition of claim 2, wherein said amino acid is a glutamic acid/tyrosine co-polymer.

4. The pharmaceutical composition of claim 2, wherein said active ingredient is L-Dopa.

5. The pharmaceutical composition of claim 2 wherein said amino acid polymer is a mixture polypeptides of varying lengths.

6. The pharmaceutical composition of claim 2 wherein said active ingredient is L-thyroxine.

7. A method of producing a polypeptide comprising co-polymerizing two amino acid derivatives, wherein the molar ratio of said amino acid derivatives is between 3 and 4.

8. A co-polymer polypeptide made by the method of claim 7.

9. The method of claim 7, wherein said amino acid derivatives are a glutamic acid derivative (Glu) and a phenylalanine derivative (Phe).

10. A co-polymer polypeptide made by the method of claim 9.

11. The method of claim 7, wherein said amino acid derivatives are a lysine derivative (Lys) and a phenylalanine derivative (Phe).

12. A co-polymer polypeptide made by the method of claim 11.

13. The method of claim 9, wherein at least one Phe is replaced by a derivative of gamma-benzylglutamic acid, tyrosine, 3-Iodo-tyrosine, 3 ,5-diiodo-tyrosine, glycine, alanine, valine, leucine, isoleucine, or methionine.

14. The method of claim 11 wherein at least one Phe is replaced by a derivative of an gamma-benzylglutamic acid, tyrosine, 3-Iodo-tyrosine, 3 ,5-diiodo-tyrosine, glycine, alanine, valine, leucine, isoleucine, or methionine.

15. A method of producing a polypeptide comprising glutamic acid and glutamine residues, comprising co-polymerizing at least one residue of glutamic acid and at least one residue of glutamine.

16. A co-polymer polypeptide that consists essentially of glutamic acid and glutamine residues.

17. A method of treating glutamine deficiency in mammals comprising oral administration of the co-polymer polypeptide of claim 16.

18. A method of treating glutamine deficiency in a cell culture comprising adding to said cell culture a nutritionally effective amount of the co-polymer polypeptide of claim 16 as a nutritional source of glutamine .

19. A cell culture comprising the co-polymer polypeptide of claim 16 as a serum substitute .

20. A method of producing a cysteine cross-linked polypeptide that comprises the constituent amino acids Cys, Pro, Glu, and Tyr, comprising co-polymerizing a Cys derivative, a Pro derivative, a Glu derivative, and a Tyr derivative.

21. A cysteine cross-linked polypeptide that consists essentially of Cys, Pro, Glu, and Tyr residues.

22. A serum comprising the polypeptide of claim 21 as a synthetic serum substitute.

23. A method of producing a globular polypeptide comprising co-polymerizing glutamic acid-N-carboxyanhydride (Glu-NCA) with proline-N-carboxyanhydride (Pro-NCA) in a Glu-NCA/Pro-NCA ratio greater than or equal to about 5.

24. A globular polypeptide consisting essentially of Glu and Pro residues, wherein the ratio of Glu/Pro is greater than or equal to 4.5.

25. A method of producing a random coiled polypeptide comprising polymerizing glutamic-N-carboxyanhydride (Glu-NCA) with proline-N-carboxyanhydride (Pro-NCA) at a Glu-NCA/Pro-NCA ratio less than or equal to about 5.

26. A random coiled polypeptide consisting essentially of Glu and Pro in a ratio of Gln/Pro of less than or equal to 4.5.

27. The amino acid polymer of claim 1, wherein at least one amino acid residue is a D-amino acid.

28. A composition comprising a non-covalently linked active ingredient and the amino acid polymer according to claim 1.

29. The composition of claim 28, wherein the active ingredient is selected from the group consisting of a nutrient, a hormone, a neurotransmitter, and a metabolic intermediate.

30. The composition of claim 28, wherein the active ingredient is capable of partitioning into a hydrophobic domain of the polypeptide.

31. The composition of claim 28, wherein the amino acid polymer is capable of releasing the active ingredient in a pH-dependent manner

32. The composition of claim 31, wherein the amino acid polymer is capable of releasing the active ingredient in the small intestine.

33. The composition of claim 31, wherein the amino acid polymer is capable of releasing the active ingredient in the stomach.

34. The composition of claim 28, wherein the amino acid polymer has a free energy of folding between about 3 kcal/mol and about 50 kcal/mol.

35. The composition of claim 28, wherein the diffusion rate of the active ingredient from the amino acid polymer is temperature sensitive.

36. The composition of claim 28, wherein the active ingredient is tryptophan.

37. The composition of claim 28, wherein the amino acid polymer is a co-polymer of lysine and phenylalanine derivatives and the active ingredient is hydrocortisone.

38. A method of treating primary adrenal insufficiency comprising administering to a patient in need the composition of claim 37.

39. The composition of claim 27, wherein the amino acid polymer is selected from co-polymers of (1) glutamic acid and phenylalanine derivatives or (2) lysine and phenylalanine derivatives; and the active ingredient is L-DOPA.

40. A method of treating Parkinson's disease comprising orally administering the composition of claim 39.

41. The composition of claim 28, wherein the amino acid polymer is selected from co-polymers of (1) glutamic acid and phenylalanine derivatives or (2) lysine and phenylalanine derivatives; and the active ingredient is aspirin.

42. A method of treating inflammation comprising orally administering the composition of claim 41.

43. A method of tableting, comprising blending an active ingredient with a synthetic polypeptide by direct compression.

44. The method of claim 43, wherein the active ingredient is aspirin and the polypeptide is polymeric glutamic acid.

45. The method of claim 43, wherein the active ingredient is hydrocortisone, and the synthetic polypeptide is a co-polymer of lysine (Lys) and phenylalanine (Phe), wherein the molar ratio of Lys/Phe is between 3 and 4.

46. The method of claim 43, further comprising blending at least one excipient.

47. The method of claim 46, wherein said at least one excipient is a filler, a pH buffer, an anti-oxidant, a disintegrant, a glidant, a lubricant, or a binder.

48. A method of synthesizing glutamic acid N-carboxyanhydride (Glu-NCA), wherein gamma carboxyl protection is not required, comprising maintaining the reaction temperature at 50 °C until the synthesis reaction is homogenous. and then heating the synthesis reaction to 63 °C for about 1 hour.

49. The method of claim 48, further comprising purifying Glu-NCA under carbon dioxide.

50. The method of claim 49, further comprising storing the purified Glu-NCA in the cold, under carbon dioxide, and in the dark.

51. A method of polymerizing glutamic acid N-carboxyanhydride (Glu-NCA), comprising initiating polymerization by addition of anhydrous ethyl acetate comprising triethylamine, then warming the reaction to reflux, then cooling the reaction.

52. The method of claim 51, further comprising purifying the polymer and converting the polymer to helical form.

53. A pharmaceutical composition, comprising poly-L-Lysine in helical form.

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